

REMARKS

5 In response to the Examiner's Action mailed on September 21, 2007, claims 1 to 60 are amended. The applicant hereby respectfully requests that the patent application be reconsidered.

10 An item-by-item response to Examiner's objections or rejections is provided in the followings:

15 1. *Rejection of Claims under 35 USC §103*

15 The Examiner rejects claims 1 to 51 under 35 U.S.C. 103(a) as being unpatentable over Patel et al. (US 2004/0125347) in view of Beerling et al (6935023). The Examiner further rejects claims 52-60 as being unpatentable over Patel et al. (US 2004/0125347) in view of Chiu et al (6639713).

20 In response to the rejections, claims 1 to 51 are amended. The amended claims are directed to invention that the micromirrors and the circuitry are formed and supported on a single substrate. Specifically, in the amended claim 1, the invention is directed to an electromechanical micromirror device, comprising:

25 a) a single semiconductor substrate with a bottom surface and a top surface opposite said bottom surface;

b) a control circuitry disposed on said bottom surface of said single substrate; and

c) a micromirror section disposed on said top surface of said single semiconductor substrate; wherein said micromirror section comprises a micromirror; and

30 d) at least one support structure for supporting said micromirror and via connectors opened through said single semiconductor substrate for connecting said control circuit to said support structure.

Claim 17 is also amended to direct to an array of electromechanical micromirror devices comprising:

- 5 a) a single semiconductor substrate with a bottom surface and a top surface opposite said bottom surface;
- b) a control circuitry disposed on said 1st bottom surface of said single semiconductor substrate; and
- c) an array of micromirror sections disposed on said top surface of said single semiconductor substrate wherein each said micromirror section comprises a micromirror; and
- 10 d) at least one support structure for supporting said micromirror and via connectors opened through said single semiconductor substrate for connecting said control circuit to said support structure.

15 Claim 34 is also amended to direct to a method of fabricating an array of electromechanical micromirrors comprising the steps of:

- 20 1) providing a single semiconductor substrate with a bottom surface and a top surface opposite said bottom surface;
- 2) forming control circuitry on said bottom surface of said single semiconductor substrate; and
- 25 3) forming a plurality of support structures on said top surface of said single semiconductor substrate and forming a plurality of micromirrors on top of and supported by said support structures and opening via connectors through said single semiconductor substrate for connecting said control circuit to said support structure.

30 The amended claims 1 to 51 are therefore totally different, novel and not obvious over Patel et al in view of Beerling et al. Specifically, Patel et al. discloses a method and structure for manufacturing micromirrors that employ two substrates, e.g., a glass substrate 280 and a silicon wafer 281 in Figs. 4A to 5A in Patel et al. Beerling et al. discloses a fluid ejection device

with print-head die mounted onto a substrate. The print head dies are formed on a separate substrate. The device as disclosed by Beerling is not supported on a single semiconductor substrate and is different from the inventions directed by the claims of this invention as now amended. The 5 amended claims 1 to 51 are therefore different, novel and not obvious over Patel et al. in view of Beerling.

The Applicant would like to respectfully disagree with the Examiner about the application of the disclosures of Beerling as a relevant prior art 10 reference for a micromirror device of this invention. Specifically, Beerling et al. disclose a fluid ejection device including a fluid channel communicating with a first side and a second side of the fluid ejection device and an array of drop ejecting elements formed on the first side of the fluid ejection device includes forming a trench in the second side of the fluid ejection device, depositing a conductive material in the trench, 15 forming a first opening in the fluid ejection device between the first side of the fluid ejection device and the conductive material in the trench, depositing a conductive material in the first opening, and forming a conductive path between the conductive material in the first opening and a wiring line of one of the drop ejecting elements. The device of Beerling 20 requires the mounting of print-heads onto the substrate and trenches opened in the substrate as fluid channel. The fluid rejection requires electric pulses to generate high temperature in the fluid channels to eject drops of fluid. The operations, the manufacturing processes, and the 25 requirements of the circuit to generate high temperatures on individual channels are totally different from the control of micromirrors of this invention. For a person of ordinary skill in the art, the disclosures of Beerling would not be a useful reference for designing and making a display modulating device using micromirrors as disclosed in this 30 invention.

For the purpose of further distinguishing from the disclosures of

September 12, 2008

Beerling, claims 1 and 17 are amended such that the device is manufactured on a "single semiconductor substrate". In contrast, Beerling's fluid ejection device is not a single semiconductor substrate but further includes printhead 12 that includes a plurality of thermal inkjet printhead dies 18 mounted to a carrier substrate 20. The printhead dies 18 are aligned in one or more rows 26 on a first surface 28 of the carrier substrate 20. Each one of the printhead dies 18 includes a plurality of rows 22 of inkjet printing elements 24, also referred to as nozzles (see FIG. 4). In the embodiment of FIGS. 1, 2 and 4 the printhead dies 18 are aligned end to end with the respective rows of each printhead die also being aligned. The carrier substrate 20 is made of silicon or a multilayer ceramic material, such as used in forming hybrid multichip modules. The substrate 20 preferably is machinable to allow formation of an ink slot, is able to receive solder and interconnect layers, and is able to receive mounting of integrated circuits.

15

For a person of ordinary skill in the art, the carrier substrate of Beerling would be totally different from and not relevant to a "single semiconductor substrate" as now included in the amended claims of this invention. For these reasons, the amended claims 1-52 would not be obvious under Patel in view of Beerling.

20

2. *Rejection of Claims under 35 USC §103*

25

The Examiner rejects claims 52-60 under 35 U.S.C. 103(a) as being unpatentable over Patel et al. in view of Chiu et al. (US 6,639,713).

30

In response to the rejections, claims 52 to 60 are amended. The amended claim 52 is directed to a method of fabricating an array of electromechanical micromirrors, comprising the steps of:

- 1) providing a single silicon-on-insulator substrate with an epitaxial top silicon layer above an insulator layer, supported by a bottom silicon layer;

2) forming control circuitry directly on said epitaxial top silicon layer;

3) removing said bottom silicon layer, thereby exposing said insulator layer;

4) forming a plurality of support structures on a surface of said insulation layer opposite said epitaxial top silicon layer followed by forming a plurality of micromirrors on top of and supported by said support structures.

5

10 The amended claims 52 to 60 are totally different and not obvious over Patel and Chiu. The device and the method of manufacturing optical devices disclosed by Chiu is to form circuits and device structure on top of a **top insulator layer 323** (shown in Figs. 19A to 19K). The processes and the functions of the circuit and the structures for supporting the mirror devices are totally different. Therefore, the micromirror device as now directed by the amended claims 52 to 60 are different, novel and non-obvious over Patel et al. in view of Chiu et al.

15

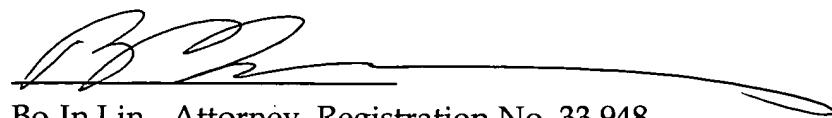
20 With the amended claims and the reasons provided above, the applicant hereby respectfully requests that Examiner's rejections under 35 USC § 103 be withdrawn and the present application be allowed.

Respectfully submitted

Fusao Ishii

5

By



Bo-In Lin - Attorney, Registration No. 33,948

13445 Mandoli Drive, Los Altos Hills, CA 94022

(650) 949-0418 (Tel), (650) 949-4118 (Fax)

September 12, 2008